

This drawing is based on a design prepared by the MidWest Plan Service (MWPS) at Iowa State University. For more specific details concerning the design refer to MidWest Plan Service Publication TR-9, Circular Concrete Manure Tanks (March 1998). This drawing may be used for tanks which are above or below ground. The design is in accordance with ultimate strength design requirements detailed in ACI 318-95.

Design Loading:

- 1. Manure load: 65 psf/ft. of depth.
- 2. Soil backfill loads: 85 psf/ft. of depth with no surcharge or 60 psf/ft. of depth with 120 psf lateral surcharge. This requires the structure backfill to be adequately drained. To meet this requirement see backfill details on this sheet.

Construction Notes:

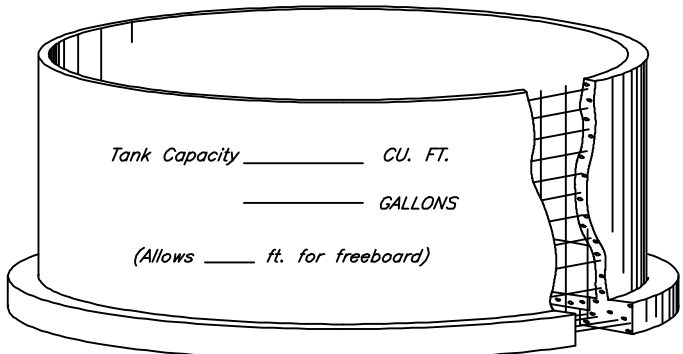
- 1. Reinforcing steel for footing and walls shall have a tension yield point of $f_y = 60,000$ psi. Refer to Sheet 2 for floor reinforcing steel grades.
- 2. For splice lengths refer to the table on Sheet 2. All bends in reinforcing steel shall have a minimum inside radius of 3 bar diameters.
- 3. All concrete shall have a minimum 28 day compressive strength of 4,000 psi. The mix design shall be submitted to NRCS prior to placement. Unless shown otherwise in the construction specifications, the following requirements shall apply:
 - Minimum cement content - 6 bags per Cu. Yd.
 - Slump - 4 inches plus or minus 1 inch.
 - Air content from 5 to 7 percent.
 - Aggregate size - maximum of 1 inch diameter.
 - Construction joints - cleaned prior to subsequent concrete placement.
 - Cure concrete for a minimum of 7 days - acceptable methods are:
 - membrane forming curing compound
 - leaving the forms in place
 - soaking / continuous spray
- 4. Construction joints may be used to ease construction. The location of construction joints shall be approved by the Engineer prior to placing the concrete.
- 5. The 1/4" x 6" steel plate in the wall to ring foundation joint shall be continuous. Steel plate sections may be butt welded or lapped & bolted with a minimum lap length of 12 inches to make them continuous.
- 6. Refer to manufacturers recommendation for placing waterstop material.
- 7. Backfill shall be brought up uniformly around the tank. The maximum difference in the finished backfill elevations around the tank shall be 3 feet.
- 8. All construction methods shall meet OSHA regulations.
- 9. See Section 302, MWPS 1, "Foundations for Farm Structures", Revised 1987, for tanks with backfill less than frost depth (Section 901, MWPS 1).
- 10. Installation of this structure shall conform to NRCS Construction Specifications.

Safety Considerations:

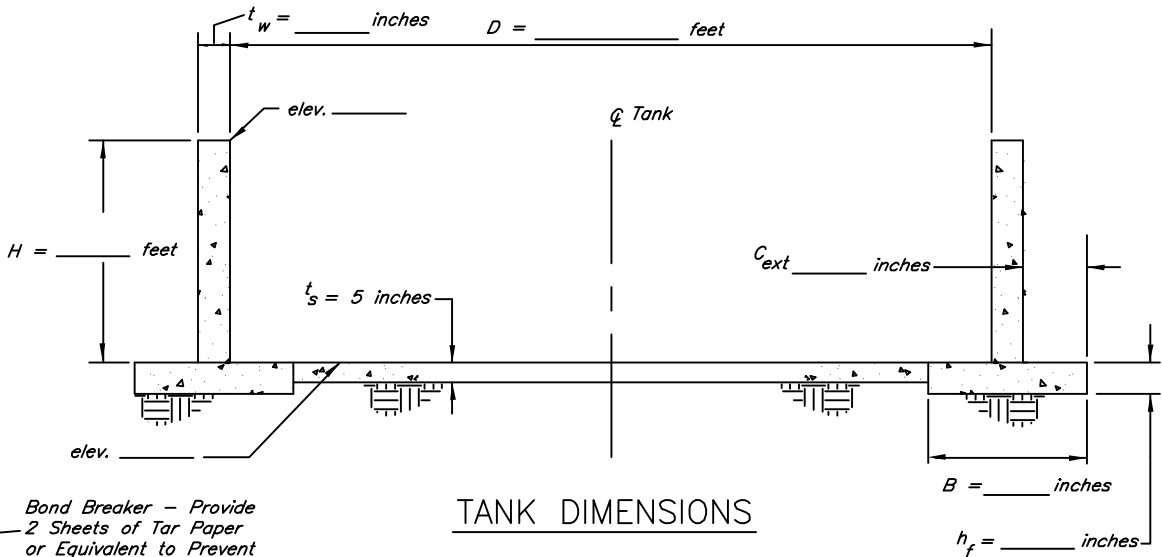
- 1. The tank shall be surrounded by a chain link or woven wire fence.
- 2. Posts shall not be cast into the concrete wall.
- 3. Safety stops shall be installed at pushoff locations to prevent accidental entry of equipment.
- 4. Warning signs shall be erected around the tank stating that entry may result in injury or death.

Unloading Station:

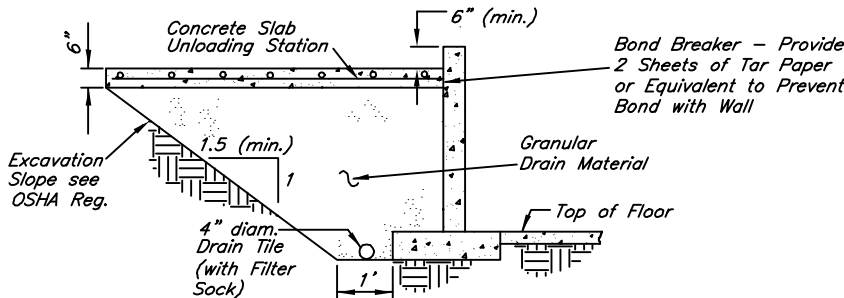
If tractors, heavy tank wagons, or trucks will be driven along the edge of the tank, cast a 6 inch thick concrete slab along the traffic route by the tank. The concrete slab should be large enough to eliminate any wheel loads directly on the natural ground or backfill by the tank. The purpose of the slab is to distribute the loading along the tank wall and prevent mud and erosion. The concrete slab should have T&S reinforcement equivalent to No. 3 bars at 18 inches C-C (steel shall be placed at or above the mid-depth of the slab). Granular backfill is required under slab.



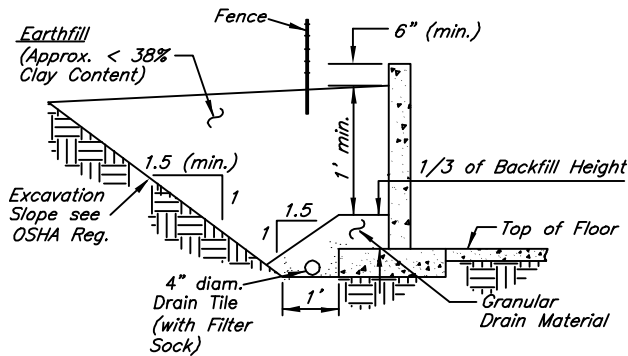
CIRCULAR CONCRETE MANURE TANK



TANK DIMENSIONS

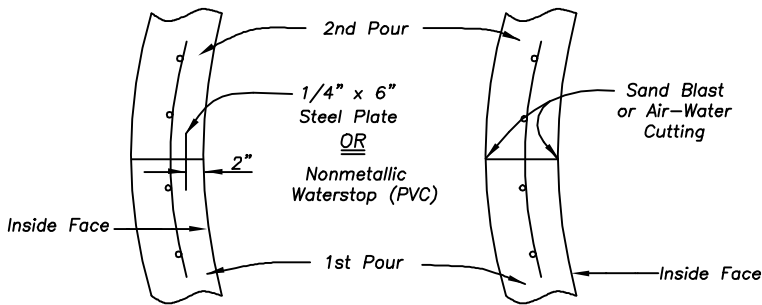


WALL BACKFILL DETAIL-UNLOADING STATION



WALL BACKFILL DETAIL-TYPICAL

- 1. Provide a minimum 4 inch diameter perimeter drain tile for wall backfill drainage. Outlet the tile at a location downstream where flow from the outlet may be monitored.
- 2. If a high water table is present a special drain design will be required under the tank floor to prevent uplift.
- 3. To provide adequate drainage, the granular drain material shall be clean with maximum 5 percent fines. The maximum particle size shall be 1.5 inches.



PLAN VIEW
TYPICAL WALL JOINT DETAIL

TABLE OF QUANTITIES

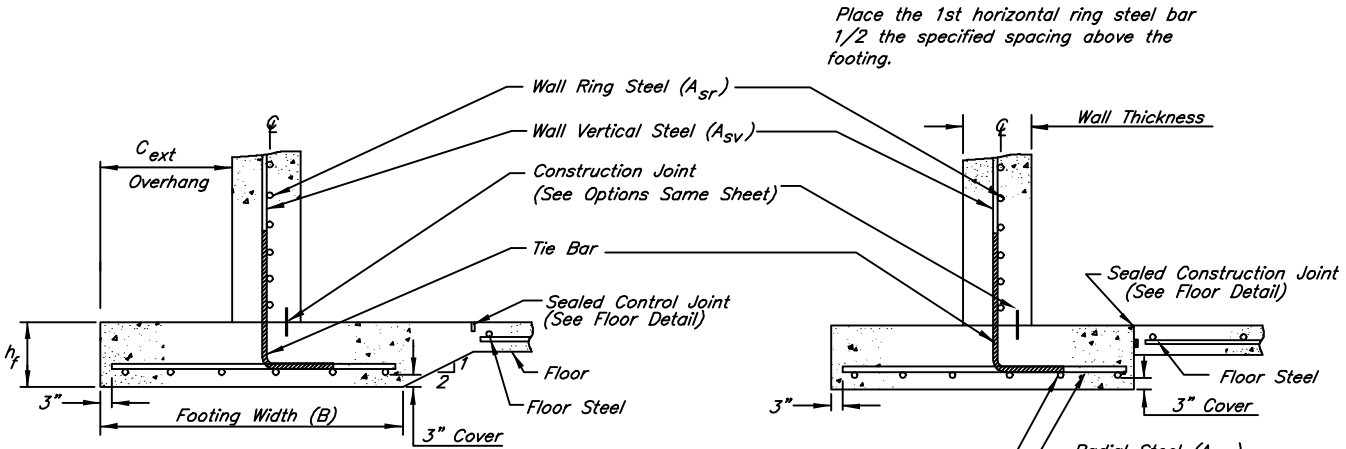
ITEM	AMOUNT		UNITS		
EXCAVATION	_____		CU. YD.		
SUBGRADE FILL	_____		CU. YD.		
BACKFILL	_____		CU. YD.		
DRAIN FILL	_____		CU. YD.		
DRAIN TILE	_____		LIN. FT.		
FENCE	_____		LIN. FT.		
SHEAR PLATE	_____		LIN. FT.		
CONCRETE CHAIRS	_____		EACH		
CURING COMPOUND	_____		GALS.		
_____	_____		_____		
CONCRETE (4,000 psi)					
Wall Footing _____	SQ. FT.	_____	CU. YD.		
Tank Floor Slab _____	SQ. FT.	_____	CU. YD.		
Wall _____	LIN. FT.	_____	CU. YD.		
Other: _____	_____	_____	CU. YD.		
TOTAL CONCRETE _____			CU. YD.		
STEEL REINFORCEMENT (Grade 60 Only)					
<u>Mark</u>	<u>Size</u>	<u>Spacing</u>	<u>Quantity</u>	<u>Length</u>	<u>Total Length</u>
A _{s1}	_____	_____	_____	_____	_____
A _{s2}	_____	_____	_____	_____	_____
A _{sv}	_____	_____	_____	_____	_____
A _{sr}	_____	_____	_____	_____	_____
Tie Bars	_____	_____	_____	_____	_____
FLOOR STEEL (Grade _____)					
<u>Mark</u>	<u>Size</u>	<u>Spacing</u>	<u>Floor Area</u>	<u>Conversion Factor (See Sheet 2)</u>	<u>Total Length</u>
Floor Steel _____	_____	_____	_____	_____	_____
TOTAL LENGTH OF #3 BARS = _____ FEET _____ LBS.					
TOTAL LENGTH OF #4 BARS = _____ FEET _____ LBS.					
TOTAL LENGTH OF #5 BARS = _____ FEET _____ LBS.					

Date _____	Approved _____	Title _____	Title _____
Date _____	Drawn _____	Traced _____	Checked _____
CIRCULAR CONCRETE MANURE TANK PLAN, CONSTRUCTION NOTES, AND QUANTITIES			
U.S. DEPARTMENT OF AGRICULTURE - NATURAL RESOURCES CONSERVATION SERVICE			
CAD FILE NAME Tr9sht1.dwg			
DRAWING NO. IA 900 (Rev. 5/99)			
SHEET NO. 1 OF 2			

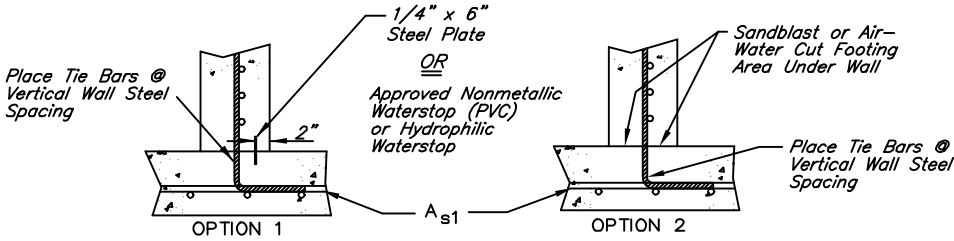
RING FOUNDATION

Footing Dimensions and Steel						
Wall Height	Tank Diameter	Footing Width	Footing Depth	Overhang	Radial Steel	Ring Steel
H	D	B	h _f	C _{ext}	A _{s1}	A _{s2}
8 ft.	all	30 in.	10 in.	12 in.	Place A _{s1} at vertical wall steel (A _{sv}) spacing. For spacing greater than 9 inches use #5 bars, otherwise use #4 bars (#5 bars could be replaced with #4 bars at 1/2 A _{sv} spacing).	#4 @ 8 in.
10 ft.	all	36 in.	12 in.	14 in.		#4 @ 6 in.
12 ft.	all	48 in.	12 in.	14 in.		#4 @ 6 in.
14 ft.	all	60 in.	12 in.	15 in.		#4 @ 6 in.

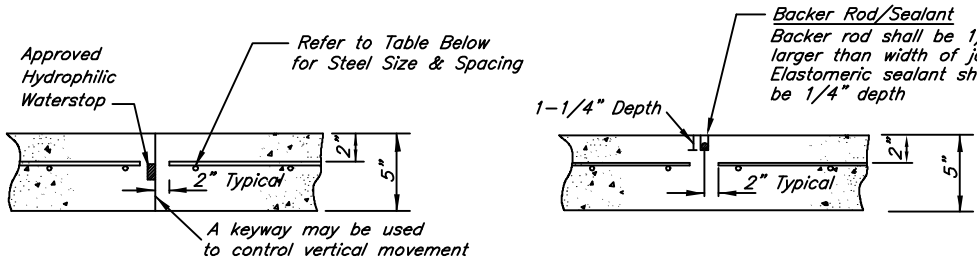
1. For tanks 10 feet and deeper, required soil bearing pressure shall be at least 2,000 psf; tanks less than 10 feet require 1,500 psf.
2. Place ring steel 3 inches above the footing bottom.
3. Place radial steel on top of ring steel.



MONOLITHIC FOOTING/FLOOR PLACEMENT
SEPARATE FOOTING/FLOOR PLACEMENT
WALL TO RING FOUNDATION DETAILS



WALL TO FOOTING CONSTRUCTION JOINT OPTIONS

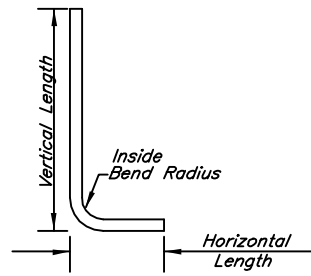


SEALED CONSTRUCTION JOINT
SEALED CONTROL JOINT

VERTICAL MOVEMENT
STRAIGHT CONSTRUCTION
JOINT OPTION

1. 5/8 inch diameter by 12 inches long smooth dowel bar coated to prevent bond at 12 inches C-C.
2. Dowels shall be parallel to concrete slab and each other.
3. Dowels shall be perpendicular to joint.
4. Dowels must not be in contact with floor steel (slab thickness may be increased at joint to accommodate dowel bars).

Control joints shall be sawed to a depth of 1/4 of the floor thickness. All control joints shall be sealed. Control joint spacing in the floor shall be based on the steel used in the floor. All joints shall be sawed to create a rectangular grid in the floor slab (the longer side of each section, excluding the slab/footing joint, shall not be more than 1.5 times the length of the shorter side).



BAR DIMENSIONS

Bar Size	#4	#5
Vertical Length	26 in.	29 in.
Horizontal Length	8 in.	11 in.
Inside Bend Radius	1-1/2 in.	1-7/8 in.
Total Length	34 in.	40 in.

1. Use the same bar size as A_{sv}

TIE BAR CONFIGURATION

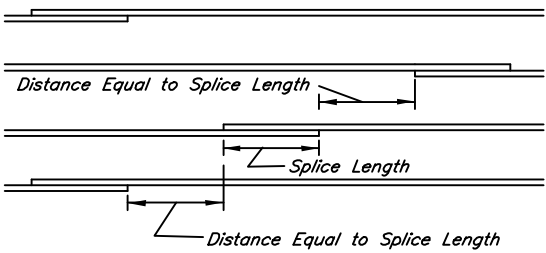
FLOOR STEEL

Steel Used	Grade 40	Grade 60	Conversion Factor
	Control Joint Spacing	Control Joint Spacing	Lin.ft./ft ² floor
#3 @ 18" C-C	40 ft.	60 ft.	1.404
#3 @ 15" C-C	50 ft.	75 ft.	1.684
#3 @ 12" C-C	60 ft.	90 ft.	2.105
#4 @ 18" C-C	75 ft.	110 ft.	1.422
#4 @ 12" C-C	110 ft.	120 ft.	2.133

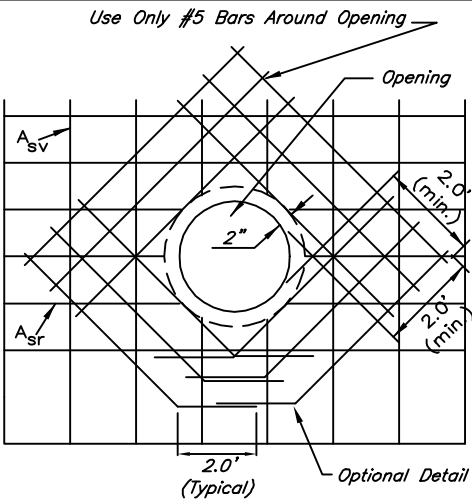
1. Check the availability of floor steel bar size and grade.
2. Allowable steel tensile stress = 2/3 of f_y.
3. Coefficient of subgrade drag = 1.5.
4. 5 inch concrete slab, unit weight = 150 pcf.

SPLICE LENGTHS FOR ALL BARS

Bar Size	Min. Splice Lengths
#3	16 inches
#4	20 inches
#5	24 inches



SPlicing Detail for Wall
AND FOOTING RING STEEL



1. Cut all vertical and ring steel 2 inches from opening.
2. For each ring steel bar interrupted by the opening, install one #5 bar around each side of the opening. A minimum 2 - #5 bars are to be used along each side.
3. Bars spacing shall not be closer than 3 inches C - C and not farther apart than A_{sr} spacing.

DETAIL OF PIPE PROTRUDING
THROUGH A WALL

Wall Height	8 ft. (8" thickness)		10 ft. (8" thickness)		12 ft. (10" thickness)		14 ft. (10" thickness)	
	Ring Steel A _{sr}	Vertical Steel A _{sv}	Ring Steel A _{sr}	Vertical Steel A _{sv}	Ring Steel A _{sr}	Vertical Steel A _{sv}	Ring Steel A _{sr}	Vertical Steel A _{sv}
Tank Diam.	Bar Size	Spacing	Bar Size	Spacing	Bar Size	Spacing	Bar Size	Spacing
30 ft.	#4 @ 12"	#4 @ 12"	#4 @ 12"	#4 @ 12"	#4 @ 9"	#4 @ 11"	#4 @ 8"	#4 @ 11"
45 ft.	#4 @ 12"	#4 @ 12"	#4 @ 10"	#4 @ 12"	#4 @ 9"	#4 @ 11"	#4 @ 7"	#4 @ 11"
60 ft.	#4 @ 12"	#4 @ 12"	#4 @ 8"	#4 @ 11"	#4 @ 6"	#4 @ 10"	#5 @ 8"	#5 @ 12"
75 ft.	#4 @ 12"	#4 @ 12"	#4 @ 8"	#4 @ 10"	#4 @ 6"	#4 @ 8"	#5 @ 7"	#5 @ 10"
90 ft.	#4 @ 8"	#4 @ 12"	#4 @ 7"	#4 @ 9"	#4 @ 6"	#4 @ 8"	#5 @ 7"	#5 @ 9"
105 ft.	#4 @ 8"	#4 @ 12"	#4 @ 7"	#4 @ 8"	#5 @ 8"	#5 @ 9"	#5 @ 6"	#5 @ 8"
120 ft.	#4 @ 6"	#4 @ 12"	#4 @ 6"	#4 @ 8"	#5 @ 8"	#5 @ 9"	#5 @ 6"	#5 @ 7"

1. For tank sizes not listed use the steel spacing & wall thickness from the next larger tank size (Maximum height is 14 feet, maximum diameter 120 feet).
2. Ring steel shall be located along the wall centerline.
3. Place vertical steel on the outside of the ring steel.
4. See MidWest Plan Service, Publication TR-9, Circular Concrete Manure Tanks (March 1998) for alternative ring steel placement (Tables 4, 5, 6, and 7).

Date	_____
Approved	_____
Title	_____
Date	_____
Designed	_____
Drawn	_____
Traced	_____
Checked	_____